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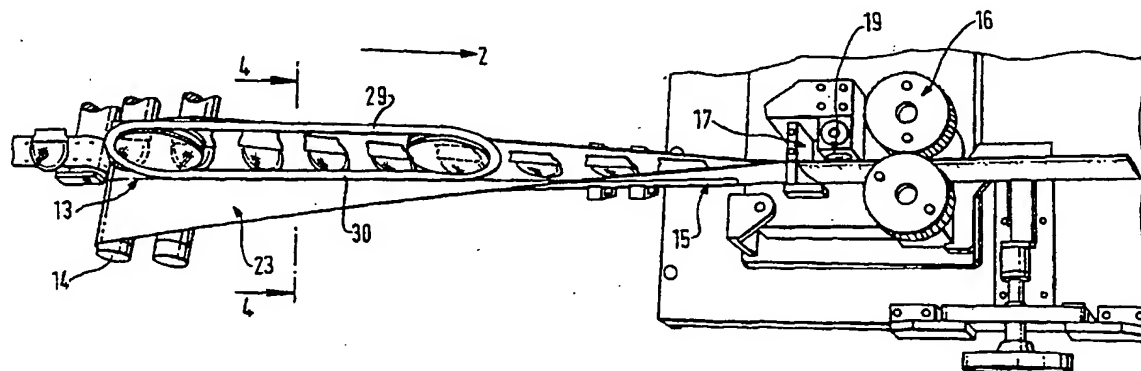
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(57) Abstract

A method and apparatus for packaging discrete, substantially planar articles in envelopes. A succession of packages are deposited on one side of a longitudinal centre line (13) of a continuous web (11). As the web moves in the longitudinal direction, it passes between a pair of spaced apart guide bars (15) which urge the side of the web either side of the longitudinal centre line (13) upwardly about the centre line (13) to fold the web about the article. When the web has been fully folded together about the articles, the web side portions are sealed together around the articles to define pockets containing one or more of the articles, which pockets can then be cut from the web to form discrete envelopes containing one or more articles.

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Method and Apparatus for Packaging Discrete Articles

5 The present invention relates to a method of, and an apparatus for, packaging discrete articles into sealed envelopes, and in particular, to packaging planar articles, such as infusion packages (e.g. teabags, coffee bags and the like) into sealed envelopes.

10 It is often desirable to package an article, such as a consumable article, in a sealed envelope in order to preserve the article; for the purpose of hygiene and/or to demonstrate that the article has not been tampered with. For example, it is desirable to pack an
15 infusion package, the wrapping of which is by its very nature permeable, in an individually sealed envelope so as to ensure that the infusion package reaches the consumer untouched by anyone else. This is particularly important where such packages are left in such locations
20 as hotel bedrooms. A further advantage is that the envelope can be attractively and informatively presented.

 Many of the envelopes in general use for this purpose do not fully meet these criteria. One potential
25 benefit of sealing an infusion package of tea, coffee or aromatic infusion herbs is to retain the flavour and aroma and control the internal atmosphere of the product, notably its humidity. Many such envelopes are however made of paper and do not fulfil these functions
30 adequately: furthermore, their flaps are usually lightly glue sealed and thus not fully tamper-proof.

 One common method of packaging an article in a sealed envelope is flow wrapping. This method comprises wrapping a web around an article moving relative to the
35 web, and sealing the opposite edges of the web to provide a tube structure with open ends. The open ends are subsequently bonded to form a sealed envelope.

One problem with this method of packaging an article is that it produces a seam, where the two edges of the web have been joined, along one face of the envelope. This is undesirable firstly, because it is aesthetically poor and secondly, because it leaves only one face of the envelope free from discontinuities to which printing can readily be applied over the entire surface.

An alternative method of packaging an article, in particular planar articles, is one in which two horizontal webs are utilised. The article to be packaged is placed on a first horizontal web and a second horizontal web is placed on top of the article and the first horizontal web. The webs are heat sealed on four sides around the article to produce a sealed, waterproof and airtight package.

This method provides a sealed envelope with two faces of the envelope free from joins or seams upon which printing may therefore be present over the whole surface.

However, one problem associated with this method is that the article to be packaged needs to be accurately positioned between the webs in both a longitudinal direction and a transverse direction with respect to the direction of motion of the first and second horizontal webs. Accurate positioning of the article in two orthogonal directions is necessary to enable the webs to be sealed on four sides around the article, such that the article does not encroach upon the areas of the webs to be sealed which would impair the quality of the seal and/or damage the article.

Another problem with this method is that the area of the web, and therefore the size of the finished package, has to be sufficiently larger than the area needed to accommodate the article to accommodate the limitations in the accuracy with which the article can be positioned on the web.

A further potential difficulty associated with this method is that the first and second horizontal webs must be accurately aligned in order to ensure that printing on those portions of the web material corresponding to the two faces of an ultimately individual envelope is in the correct position. Errors in positioning the webs relative to one another can result in the misalignment of the two envelope faces such that when the sealed webs are cut into their individual envelopes, the printing on one face is misaligned with that on the other face.

According to a first aspect of the present invention, there is provided a method of packaging discrete, substantially planar articles, comprising:

positioning successive articles on one side portion of a generally horizontal longitudinally moving web;

folding the opposite side portions of the web upwardly and towards one another about a longitudinal fold line, the articles thereby being pivoted upwardly from their initial generally horizontal positions;

sealing the web side portions together around the articles to define pockets each containing one or more articles; and

cutting the pockets to form discrete envelopes each bounded by said fold line along one edge and by a seal around the remaining edge or edges.

In the method of the present invention, each article requires accurate positioning on the web in the longitudinal direction only. In a preferred method of the present invention, the discrete articles are longitudinally accurately positioned relative to one another before being positioned on the web. The accurate positions of the articles are maintained and the articles then transferred to the generally horizontal web.

It is not necessary to position the articles so accurately in a direction transverse to the direction of motion because as the two side portions of the web are

folded upwardly and the article is thereby pivoted, the gravitational force acting on the article causes it to fall against the longitudinal fold line in the web. Thus, the article is located against the fold in the web and is thereby accurately located in the transverse direction.

The method of the present invention also ensures that, as a consequence of the article falling against the fold in the web, the area of the web on that side is no larger than it needs to be to accommodate the article and therefore material requirements are reduced.

The discrete article is initially positioned on a portion of the web which is to one side of a longitudinal centre line of the web. The web is preferably folded upwardly about the longitudinal centre line although the method of the present invention is not limited to this embodiment. The applicants envisage that the web could, for example, be folded about a longitudinal line which does not correspond to the centre line of the web. In such an embodiment, the two side portions of the web which are folded upwardly would not be symmetrical.

Since a single web is used to form the envelope rather than two webs, the method of the present invention does not require two separate webs to be accurately aligned in the longitudinal and transverse directions. Folding a single web ensures that the portions of the web which ultimately form the two outer faces of the envelope are accurately aligned and thus, no printing on the faces of the web is lost. Any printing on opposite faces of the envelope can be aligned as required.

In the method of the present invention, the web is, prior to folding, oriented generally horizontally, although it may be inclined at a small angle to the horizontal provided that, when the discrete article is positioned on the web, the article remains in the same

longitudinal position relative to the web.

After upward folding, the side portions of the web, where the article is not present, are sealed together to enclose preferably a single article such as an infusion package. Preferably, the side edges of the web are sealed together in a longitudinal direction and web portions intermediate the articles are sealed transversely so that rectilinear envelopes are formed although other shapes are possible. For example, purse shaped envelopes could be provided with a straight folded edge and one or more curved sealed edges around the rest of the periphery.

In the method of the present invention, the portions of the web which form the two faces of the ultimately discrete envelope may be free from seams, joins or any other form of discontinuity. This is aesthetically pleasing and allows printing to be present on both faces.

The present invention also extends to an apparatus for carrying out the above method.

Thus, according to a second aspect of the present invention, there is provided an apparatus for packaging discrete, substantially planar articles, comprising:

means for positioning successive articles on one side portion of a generally horizontal web;

means for folding the opposite side portions of the web upwardly and towards one another about a longitudinal fold line, the articles thereby being pivoted upwardly from their initial generally horizontal positions;

means for sealing the web side portions together around the articles to define pockets each containing one or more articles; and

means for cutting the pockets to form discrete envelopes each bounded by said fold line along one edge and by a seal around the remaining edge or edges.

The positioning means of the apparatus of the

present invention need only accurately locate the discrete articles relative to one another in the longitudinal direction.

5 The discrete articles may be transported to the horizontal web by any suitable means. They may, for example, be transported on a conveyor arrangement.

10 In a particularly preferred embodiment, the articles are delivered at an approximately constant pitch onto a horizontal conveyor which delivers them to the upstream end of the web.

The position of the articles relative to the conveyor is preferably initially maintained by inducing a vacuum underneath the conveyor.

15 As the articles are transported on the conveyor, they preferably pass through an accurate positioning region in which the articles can move relative to the conveyor. In the preferred embodiment, no vacuum is induced underneath the conveyor at that region.

20 In the positioning region, the position of the packages is adjusted on the conveyor in a longitudinal direction such that each package is positioned precisely at a predetermined distance from each adjacent package.

25 In one embodiment, the positioning means comprises a plurality of positioning members which make contact with the discrete articles to urge them into their correct longitudinal positions. In a preferred embodiment, the positioning means comprises a plurality of positioning arms carried by a moving belt. The belt can be arranged to cooperate with the conveyor carrying the articles such that the arms, or a part thereof, will engage the articles on the conveyor in the positioning region to urge the articles into position. The belt is driven by any suitable means such that the positioning arms move in the same direction of motion as the articles on the conveyor. The belt is driven at a substantially constant speed but at a slightly different speed to that of the conveyor. The speed of the belt

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may be slower or faster than the speed of the conveyor, but in the preferred embodiment, the belt speed is the slower of the two. Thus, in the preferred embodiment, the resultant speed differential causes the discrete
5 articles to move more rapidly in a longitudinal direction than the positioning arms causing the articles to abut against the positioning arms. The speed differential is sufficient to cause each discrete article to be moved so as to abut a positioning arm and
10 thus accurately position each article. The intervals between the positioning arms are selected to accurately locate each discrete article a predetermined distance from each adjacent article.

Once the positioned articles are outside the
15 positioning region, their position is again maintained relative to the conveyor preferably by means of vacuum.

The articles are then transferred to the substantially horizontal web which is continuously supplied from one or more reels in accordance with a
20 conventional supply mechanism. The web and the conveyor are preferably substantially at the same vertical height and the speeds of the web and the conveyor in the longitudinal direction are substantially the same. Thus, the accurate positioning of the discrete articles
25 is maintained on the horizontal web.

The folding means of the apparatus of the present invention preferably comprises a guide means which urges the two side portions of the web upwardly as the web passes through the guide means, as the web travels in a
30 longitudinal direction. In a preferred embodiment, the guide means comprises a pair of spaced apart guide bars which extend and taper towards each other in the longitudinal direction. The web passes between the guide bars and is folded together as the separation
35 between the guide bars steadily decreases in the longitudinal direction. The guide bars are preferably of round cross-section and may be manufactured from any

suitable material. The guide means preferably further includes a guide comprising an aperture shaped to accommodate the cross-sectional shape of a fully folded web arranged downstream of the initial guiding means, such as the guide bars.

To encourage the web to fold, the apparatus is preferably provided with a blade which scores the length of the web at a point about which the length of the web will be folded. In a particularly preferred embodiment, the blade is circular and rotates to continuously score the continuous web supply.

The apparatus preferably further comprises means for substantially preventing, at least as the web is initially folded, the articles from slipping across the intended longitudinal fold line. Such slippage beyond the fold line could occur while the web is only forming a shallow 'V' as it is initially folded and before the far side of the web is too steep for the articles to slide up.

In a preferred embodiment therefore, a continuously recirculating endless belt is arranged to run parallel to and along or adjacent the longitudinal fold line of the web. The part of the belt adjacent the web should be sufficiently close to the web that the articles cannot pass between it and the web. It is preferably therefore substantially in contact with the web. This belt will then prevent the articles from slipping beyond the fold line as the web is folded.

The belt is preferably arranged upstream of the folding and guide means and preferably extends along the web substantially from the point at which the articles are laid on the web to where the guide or folding means start. The belt is aligned with the web in a longitudinal direction and preferably recirculates in a plane substantially perpendicular to the horizontal web. It is preferably of round cross-section. The lower strand of the belt substantially in contact with the web

preferably moves at the same speed as the web. The lower strand of the belt thus prevents the discrete articles from slipping beyond the fold line of the horizontal web.

5 The folded web may be sealed by any suitable means. In a preferred embodiment, the sealing means comprise a pair of longitudinal pressure sealing rollers. The edge regions of the web are preferably pre-printed with a pressure sensitive adhesive which is actuated under the
10 pressure of the rollers.

 In a preferred embodiment, the sealing means further comprise a pair of transverse pressure sealing rollers comprising angularly spaced sealing surfaces, the rotation of the rollers being suitably synchronised
15 with the positions of the articles by any suitable known means.

 In a preferred embodiment, the cutting means comprise a pair of transverse cutting rollers which include angularly spaced blades suitably synchronised
20 with the transverse sealing means to seal the web along the transverse seals between the articles.

 The apparatus of the present invention preferably includes a means for ensuring the separation of the discrete envelopes, which have been formed by cutting
25 the folded, sealed web. In a preferred embodiment, the separating means comprise a pair of separating rollers between which the envelopes pass. The separating rollers preferably rotate at a higher speed than the cutting rollers such that when the envelopes are gripped
30 between the separating rollers, the envelopes are pulled in a longitudinal direction at a speed which is slightly higher than that of the envelopes which have not yet passed through the separating rollers.

 The discrete envelopes preferably fall on to a
35 transporting means which conveys the discrete envelopes to a collation and packaging area. The apparatus used for collating and packaging the envelopes may be, for

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example, in accordance with the apparatus disclosed in GB 9724481.8.

The present invention is particularly applicable to the packaging of discrete, substantially planar articles, such as infusion packages containing tea, coffee or herbs or the like, but it could equally be applied to the packaging of other discrete articles, and particularly to the packaging of other, substantially planar articles.

A further aspect of the present invention provides a sealed envelope containing a substantially planar article, such as an infusion package, which has been formed by the method and/or the apparatus described above.

A preferred embodiment of the present invention will now be described by way of example only and with reference to the accompanying drawings, in which:

Figure 1 shows the longitudinal positioning apparatus and part of the horizontal web in accordance with the invention.

Figure 2a shows a generally plan view of the web folding apparatus and the longitudinal sealing apparatus;

Figure 2b shows a section view of the folding web and the recirculating belt shown in Figure 2a;

Figure 3 shows a generally side view of both the longitudinal and transverse sealing apparatus, the cutting apparatus and the separating apparatus; and

Figure 4 shows a view of the folding apparatus and the longitudinal sealing apparatus taken along line 4-4 of Figure 2a.

Referring to Figure 1, there is shown an apparatus 1 for accurately positioning in a longitudinal direction tagged infusion packages 3, such as those made in accordance with WO 96/15033.

A continuous stream of infusion packages 3 are delivered from the package making module (not shown) on

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to a horizontal conveyor 5. The infusion packages are delivered at a substantially constant pitch and within about $\pm 5\text{mm}$ of their nominal position. A conventional electronic sensor (not shown) detects the presence of each infusion package on the horizontal conveyor 5. The belt of the horizontal conveyor is driven at a constant speed of about 0.666 m/s by means of a servo controlled motor so as to ensure accurate speed control.

The accurate positioning of the infusion packages on the conveyor 5 is achieved by means of a plurality of positioning arms 7 which are attached at regular intervals to a moving belt 9. The arms extend from the belt 9 in a direction transverse to the longitudinal direction of motion of the conveyor. Each arm 7 comprises two positioning pins 8, one toward each end of the arm 7, which extend perpendicularly from the plane of each arm. The belt 9, arms 7 and pins 8 are arranged such that the packages 3 on the conveyor cannot pass beneath the pins when the pins face the conveyor 5, i.e. when the pins 8 are at their minimum spacing from the conveyor.

The belt 9 is driven such that in the region where the belt is moving in a longitudinal direction, the speed of the belt is about 0.625 m/s . Thus, there is a speed differential between the belt 9 and the horizontal conveyor 5 such that the conveyor 5, and therefore the infusion packages 3, move in a longitudinal direction more rapidly than the positioning arms 7. Therefore, the infusion packages are caused to abut against the positioning pins 8 of the positioning arms and thus, each package is accurately positioned a defined distance from each adjacent package on the conveyor 5. In a preferred embodiment, the infusion packages can be moved on the conveyor a distance of about 7.5mm .

The position of the infusion package is controlled primarily by the contact of the positioning pin 8 nearer the belt 9. This pin is the one of the two pins which

5 makes contact with the cardboard tag portion 4 of the package 3. The Applicants have found that this harder contact provides more control in the positioning of the package than contact with the soft tissue of the package.

10 To ensure that the infusion package remains accurately positioned on the horizontal conveyor 5, the conveyor is perforated 10 and a vacuum is induced such that the infusion package is held in close contact with the belt surface. A vacuum is also induced in the first section of the conveyor to maintain the position of the infusion packages with respect to the moving conveyor 5, when the packages are delivered on to the conveyor by the package making machine. However, a vacuum is not
15 induced in the central section of the conveyor where the positioning arms 7 are present because the packages need to be free so that they can be moved by the positioning pins 8.

20 The speed of both the conveyor 5 and the belt 9 could be varied to produce the appropriate speed differential for the rate of delivery of the infusion packages from the package making module. The number and spacing of the positioning arms could also be selected to produce the required spacing of the packages.

25 In an alternative embodiment, the belt 9 could be driven such that, in the region where the belt is moving in a longitudinal, horizontal direction, the speed of the belt, and therefore the positioning arms 7, is faster than that of the horizontal conveyor 5. In this
30 embodiment, the positioning arms push against the rearward edges 6 of the packages to accurately locate the packages, whereas in the previous embodiment, the higher speed of the conveyor 5 causes the positioning arms 7 to push against the forward edges of the infusion
35 packages to accurately locate the packages.

Referring to Figure 1, the positioned infusion packages are transferred from the horizontal conveyor 5

to a horizontal web 11. The web material is fed from one of two reels (not shown). To maintain a continuous supply of the web material, when the web supply in a first reel is almost depleted, the supply is switched
5 from the first reel to a second reel using a standard splicing technique in accordance with a conventional feeding mechanism.

The horizontal conveyor 5 and the horizontal web 11 are both at the same vertical height and move at the
10 same speed. Therefore, the accurate position of the infusion packages on the conveyor 5 is maintained on the horizontal web 11. If desired, discrete small areas of adhesive may be applied to the surface of the web to initially maintain the positions of the packages on the
15 horizontal web. However, this adhesive should not be such as to prevent the packages from falling under the force of gravity as the web is folded upwardly as described.

Referring to Figure 2a, the horizontal conveyor 5
20 deposits the packages on the web 11 on one side of a longitudinal centre line 13 of the web. A circular blade (not shown) adjacent roller 14 scores the web 11 at the position of the centre line 13 to form a crease in the web. As the web moves in a longitudinal
25 direction, it passes between a pair of spaced apart round section guide bars 15. The guide bars extend in the longitudinal direction and the separation between the guide bars steadily decreases in the longitudinal direction. Thus, the sides of the web either side of
30 the longitudinal centre line 13 are folded upwardly about the crease along the centre line 13 as the web passes between the guide bars. This is clearly illustrated in Figure 4.

As the sides are folded upwardly, the gravitational
35 force acting on the infusion package 3 causes the package to fall into the fold such that the package is closely positioned against the fold.

To prevent the packages from slipping beyond the longitudinal fold line 13 of the horizontal web during the initial folding of the web, an endless polyurethane belt 29 is provided which recirculates in a plane perpendicular to the horizontal web 11. The belt is aligned with the web in a longitudinal direction and is of round cross-section. A lower strand 30 of the belt is in contact with the web and moves at the same speed as the web 11. The lower strand 30 of the belt prevents the infusion packages 3 from slipping beyond a fold line 13 of the horizontal web (see Figure 2b).

The edge regions 23 of the web are pre-printed with adhesive and as the folded web passes through envelope guide 17, the edge regions, which correspond to the top of the envelope, are in contact with each other. With reference to Figure 4, the aperture in the envelope guide 17 is shaped so as to accommodate the folded web containing the infusion packages.

Referring to Figure 3, the edge regions of the outer surface of the folded web comprise a pre-printed mark at regular intervals. The printed mark is a registration mark which is detected by optical sensing equipment 19. The marks allow the start and end positions of each ultimately discrete envelope to be determined. Minor adjustments to the position of the folded web can be made on the basis of the marks to ensure that sealing of the web is executed in the correct positions.

Referring to Figure 3, the folded web is in an upright position and is drawn in a longitudinal direction 2 by a pair of longitudinal pressure sealing rollers 16. The edge regions 23 of the two sides of the folded web are sealed by the longitudinal sealing surfaces 18 of pressure sealing rollers 16.

The longitudinally sealed folded web is drawn through a pair of transverse pressure sealing rollers 20 and the two sides of the folded web are sealed

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transversely by transverse sealing surfaces 22 at the position of each registration mark. Each infusion package is thus sealed on three sides in an envelope which is folded on a fourth side.

5 A joined succession of sealed envelopes pass through a pair of cutting rollers 24 which comprise a plurality of blades 26. The blades transversely cut the sealed envelopes at the position of each registration mark along a centre line of each transverse seal to
10 produce discrete sealed envelopes.

 To ensure that each envelope is cleanly separated from adjacent envelopes, a pair of separating rollers 28 are provided. The rotational speed of the separating rollers is higher than that of the cutting rollers such
15 that as each envelope passes between the pair of rollers 28, it is pulled from the next, adjacent envelope. The discrete envelopes fall into a horizontal position on an exit conveyor 21 which transports the discrete envelopes to a collation area. In the collation area a
20 predetermined number of the discrete envelopes are packaged together in a carton in accordance with a conventional packaging method and apparatus.

CLAIMS

1. A method of packaging discrete, substantially planar articles, comprising:

5 positioning successive articles on one side portion of a generally horizontal longitudinally moving web;

 folding the opposite side portions of the web upwardly and towards one another about a longitudinal fold line, the articles thereby being pivoted upwardly from their initial generally horizontal positions;

 sealing the web side portions together around the articles to define pockets each containing one or more articles; and

15 cutting the pockets to form discrete envelopes each bound by said fold line along one edge and by a seal around the remaining edge or edges.

2. The method of claim 1 further comprising:

20 longitudinally positioning the articles relative to one another before positioning the articles on the web.

3. The method of claim 2, wherein the longitudinal positioning step comprises positioning successive articles on a conveyor which delivers the articles to the upstream end of the web and, while the articles are on the conveyor, engaging the articles against positioning members which are arranged to cooperate with the conveyor in such a way as to engage the articles and urge them longitudinally relative to the conveyor.

4. The method of claim 3, wherein the positioning members comprise a plurality of positioning arms carried by a moving belt, the method further comprising driving the belt such that the positioning arms move in the same direction of motion as the articles on the conveyor but at a different speed to the speed of the conveyor,

whereby the resulting speed differential causes the discrete articles to abut against the positioning arms as they travel past the belt on the conveyor.

- 5 5. The method of claim 1, 2, 3 or 4 wherein said folding step comprises folding the opposite side portions of the web upwardly and towards one another about the longitudinal centre line of the web.
- 10 6. The method of any one of claims 1 to 5, wherein the envelopes formed are rectilinear.
7. The method of any one of claims 1 to 6, wherein the envelopes each contain a single article.
- 15 8. The method of any one of claims 1 to 7, wherein the articles are infusion packages.
9. An apparatus for packaging discrete, substantially planar articles comprising:
- 20 means for positioning successive articles on one side portion of a generally horizontal web;
- means for folding the opposite side portions of the web upwardly and towards one another about a
- 25 longitudinal fold line, the articles thereby being pivoted upwardly from their initial generally horizontal positions;
- means for sealing the web side portions together around the articles to define pockets containing one or
- 30 more articles; and
- means for cutting the pockets to form discrete envelopes each bounded by said fold line along one edge and by a seal around the remaining edge or edges.
- 35 10. The apparatus of claim 9 wherein the positioning means comprises a conveyor which delivers the articles to the upstream end of the web.

11. The apparatus of claim 10, further comprising a plurality of positioning members which can be arranged to co-operate with the conveyor carrying the articles such that the positioning members will engage the articles on the conveyor to urge the articles longitudinally relative to the conveyor.

12. The apparatus of claim 11, wherein the positioning members comprise a plurality of positioning arms carried by a moving belt.

13. The apparatus of claim 12, further comprising means for driving the belt such that the positioning arms move in the same direction of motion as the articles on the conveyor but at a different speed to the speed of the conveyor, whereby the resulting speed differential causes the discrete articles to abut against the positioning arms as they travel past the belt on the conveyor.

14. The apparatus of any one of claims 9 to 13, wherein the folding means comprises guide means arranged such that the two side portions of the web are urged upwardly and towards each other as they pass through the guide means.

15. The apparatus of claim 14, wherein the guide means further includes a guide comprising an aperture shaped to accommodate the cross-sectional shape of a fully folded web.

16. The apparatus of any one of claims 9 to 15, wherein the apparatus further comprises means for substantially preventing the articles from slipping across the longitudinal fold line as the web is initially folded.

17. The apparatus of claim 16, wherein the means for

preventing slipping is a continuously recirculating endless belt arranged to run parallel to and along or adjacent the longitudinal fold line of the web.

5 18. The apparatus of any one of claims 9 to 17, further comprising means for separating the discrete envelopes which have been formed by cutting the folded sealed web.

10 19. The apparatus of claim 18, wherein the cutting means comprise cutting rollers and the separating means comprise a pair of separating rollers arranged to rotate at a higher speed than the cutting rollers.

15 20. The apparatus of any one of claims 9 to 19, wherein the articles are infusion packages.

20 21. A sealed envelope containing an infusion package which has been formed by the method of any one of claims 1 to 8 or using the apparatus of any one of claims 9 to 20.

25 22. A method of packaging discrete, substantially planar articles, substantially as hereinbefore described with reference to Figures 1 to 4 of the accompanying drawings.

30 23. An apparatus for packaging discrete, substantially planar articles substantially as hereinbefore described with reference to any one of the accompanying drawings.

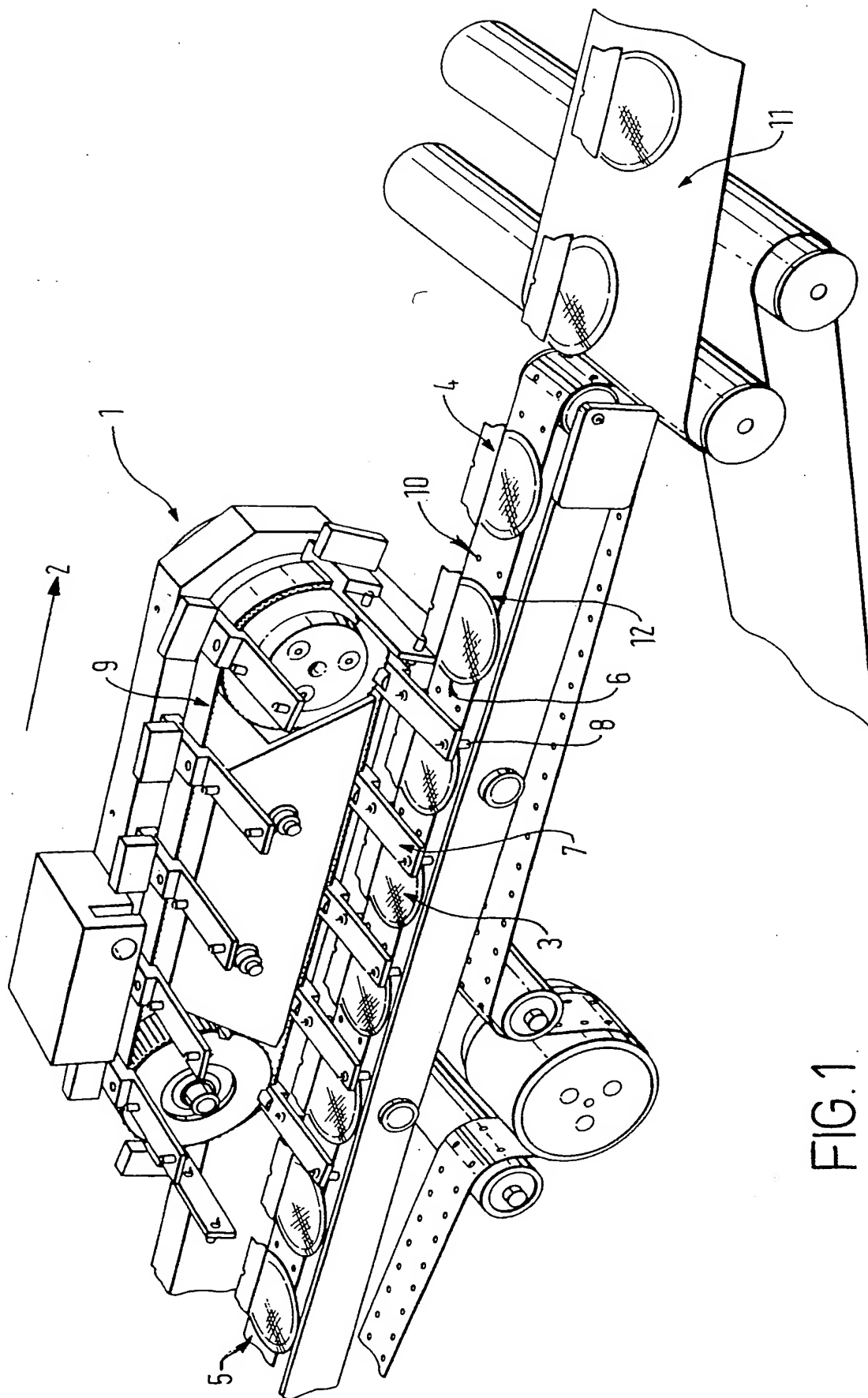


FIG. 1

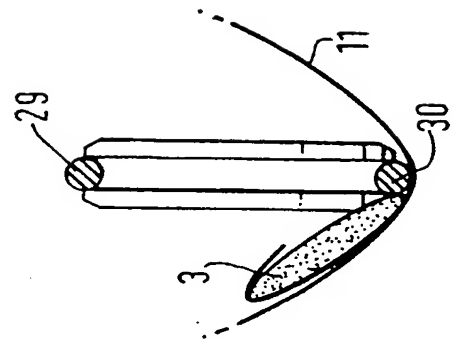
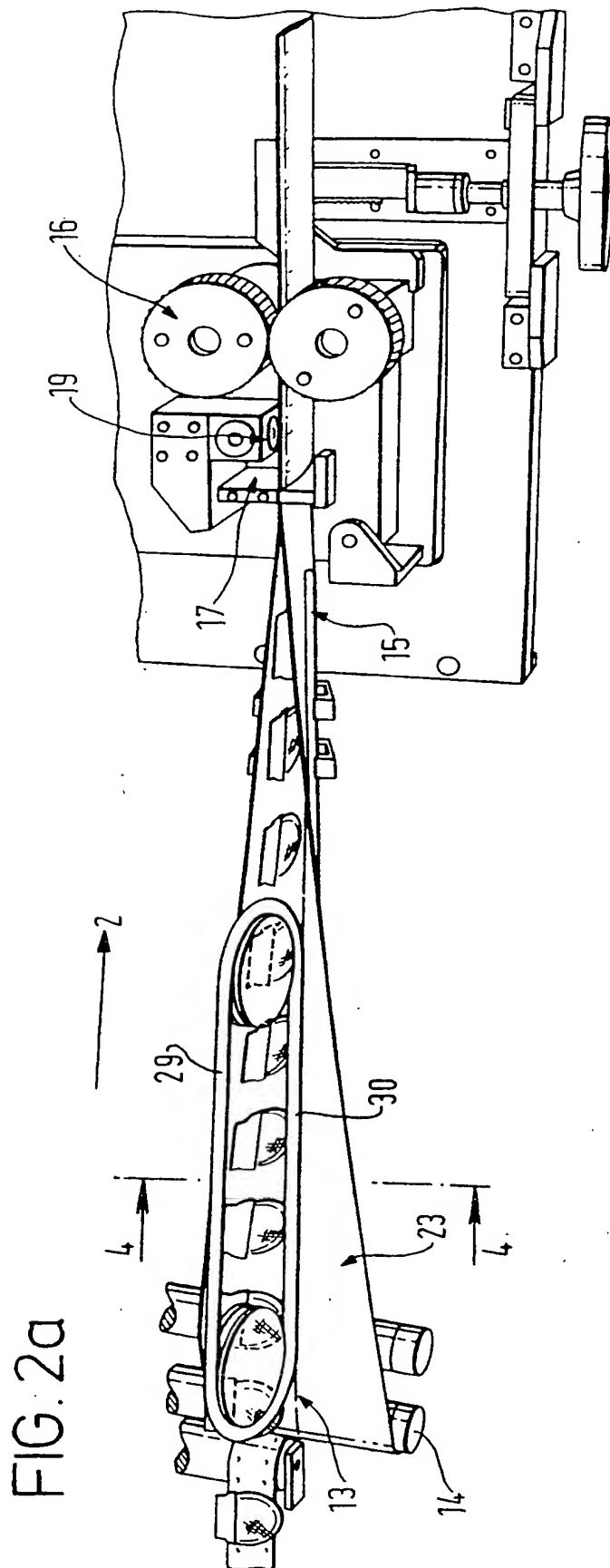


FIG. 2b

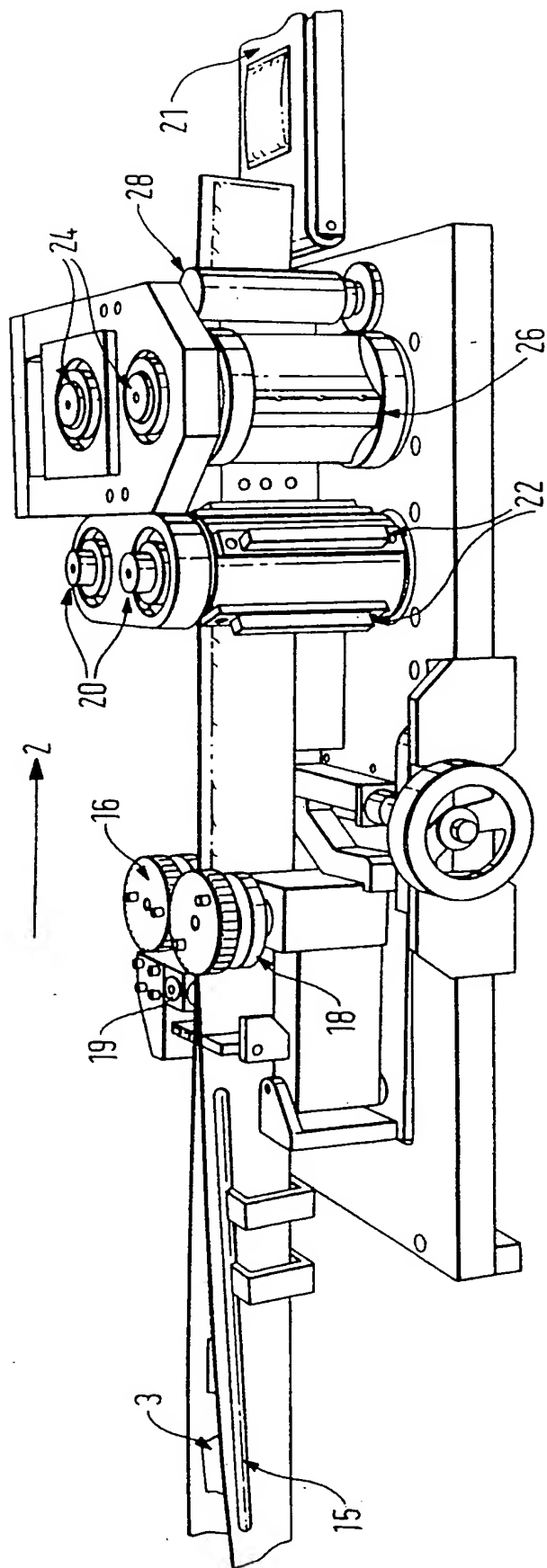


FIG. 3

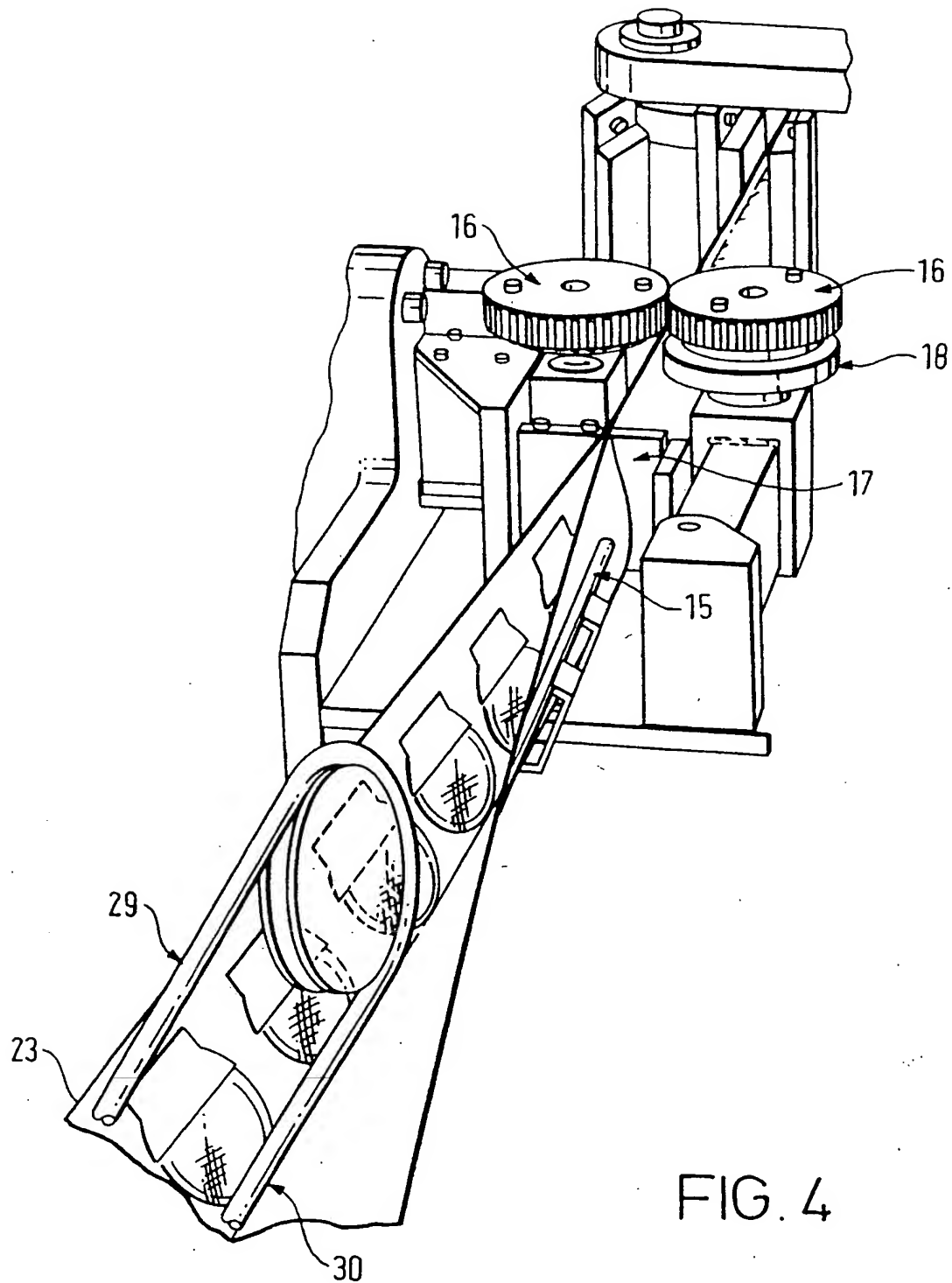


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/GB 99/01934

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B65B 9/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B65B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3274746 A (R.C. JAMES ET AL), 27 Sept 1966 (27.09.66) --	
A	US 4663915 A (DONALD L. VAN ERDEN ET AL), 12 May 1987 (12.05.87) --	
A	EP 0531701 A1 (KRAFT GENERAL FOODS, INC.), 17 March 1993 (17.03.93) -- -----	

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"I" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation of other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

24 Sept 1999

12.11.99

Name and mailing address of the international Searching Authority
European Patent Office P.O. Box 1
NL 2280 HV Rijswijk
Tel: +31-70 340-2040 Fax: +31-70 340-2046
E-mail: epo@epo.nl

Authorized officer

Erik Wiss/ELY

INTERNATIONAL SEARCH REPORT

International application No.

PCT/GB99/01934

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: 22, 23
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

They are not clear and concise.
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/GB 99/01934

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
US	3274746	A	27/09/66	NONE		
US	4663915	A	12/05/87	AU	572570 B	12/05/88
				AU	3419284 A	09/05/85
				CA	1225070 A	04/08/87
				US	4589145 A	13/05/86
EP	0531701	A1	17/03/93	AT	145182 T	15/11/96
				AU	649854 B	02/06/94
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				CN	1070376 A	31/03/93
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				ES	2096682 T	16/03/97
				GR	3021848 T	28/02/97
				HK	96697 A	08/08/97
				JP	5262335 A	12/10/93
				NZ	243775 A	23/12/93
				SG	45421 A	16/01/98
				US	5247781 A	28/09/93